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AUTHOR Robeck, Carol P.
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ABSTRACT

A study was conducted to investigate the relationships between the cognitive variables of cognitive style, understanding of linguistic concepts, and knowledge of word boundaries, as well as their relationships to three measures of reading in beginning and more advanced readers. The children's Embedded Figures Test, a linguistic concept test, a word boundary test, and an individual reading inventory were administered to 35 first grade and 31 third grade children. Correlations, multiple linear regression analyses, and commonality analyses were used to analyze the data. The results indicated a substantial relationship between the predictor and criterion variables at the first grade level: however, the relationships were considerably weaker at the third grade level. Linguistic concept knowledge contributed the greatest amount of unique variance to oral comprehension, silent comprehension, and word recognition at the first grade level. At the third grade level linguistic concept knowledge contributed the greatest amount of unique variance to oral comprehension and word recognition, while cognitive style contributed the greatest amount of unique variance to silent comprehension. (Author/RL)

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A STUDY OF COGNITIVE STYLE, KNOWLEDGE OF LINGUISTIC CONCEPTS, AND READING ACHIEVEMENT OF FIRST AND THIRD GRADE CHILDREN

Carol P. Robeck

Texas A&M University

College of Education
College Station, Texas 77843

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Two seemingly unrelated areas which have received attention in the 1970's as possible indicators of successful beginning reading achievement are cognitive style, specifically Witkin's et al. (1977) concept of field independence-dependence and linguistic concept development--the developing understanding of concepts related to reading instruction such as "letter sound" (phoneme), "word", and "sentence" as well as the understanding of word boundaries as defined by the printer's space.

Problem

According to Witkin, the field independent person is analytical, one who is able to extract or perceive an embedded element from a surrounding field, while the field dependent person perceives a field globally and has difficulty separating an element from the field itself. Research by Witkin has indicated that cognitive style is a critical component in the learning process and that field-independent subjects go about problem solving in a very different manner than field-dependent subjects especially in those problem-solving situations which require the individual to extract a critical element out of its context and restructure it in a different context.

Studies investigating children's understanding of linguistic terms related to reading instruction and knowledge of word boundaries have indicated that children do not have well-developed notions of what a "letter-sound" (phoneme), "word", and "sentence" are nor do they always segment a sentence into its component words even after a year of reading instruction. The evidence gathered thus far seems to indicate that increase in linguistic concept development occurs with reading instruction and that after a year of instruction the better readers appear to have a better developed concept of linguistic terms and word boundaries.

A secondary finding of the research on linguistic concept development is that classroom teacher's spend relatively little time providing instruction that would promote development of these concepts. Apparently, the assumption is that children already understand these concepts. Under these circumstances, it seems likely that young children who tend to be field-independent would be more able than field-dependent children to analyze the use of linguistic terms in the different reading instruction lessons and to generalize the instances of use to determine the concept. It also seems likely that the field-independent child would be more able than the field-dependent child to extract a word from its context, the sentence, and a letter-sound from its context, the word. Each of these abilities may contribute to successful reading performance.

Review

Support for a relationship between cognitive style and reading achievement can be found in the literature. Much of the research investigating cognitive style and reading has been done with older children who are past the beginning stages of learning how to read (Cohn, 1968; Fiebert, 1967; Higgins & Gage, 1968; Nadien, Schaeffer & Schmeidler, 1969; Stone, 1976; Stuart, 1967, Wineman, 1971). These studies have found low but significant correlations between cognitive style and reading achievement.

The study by Stone (1976) included fifth grade children as well as second grade children. Stone found that the contribution of cognitive style was greater for second grade than for fifth grade. Based on a review of cognitive style literature by Goodenough (cited in Stone, 1976), Stone suggested that the evidence from the findings supports the hypothesis that "cognitive style may be a mediating or 'process' variable which has its

greatest impact when a person is first learning a series of patterns of skills" (p. 333). This hypothesis has gained support from three studies that have investigated cognitive style and reading in young children.

Using the children's Embedded Figures Test (CEFT) and the Reading Subtest from the Stanford Achievement Test, Watson (1970) found that scores from the Reading Subtest and the CEFT of first, second, and third grade children were significantly correlated at the .01 level. Schwartz (1973) administered the CEFT, the California Test of Mental Maturity and thirty words in isolation and in the context of sentences and paragraphs (based on the Stanford Reading Inventory) to 60 second grade children. With intelligence held constant, a positive relationship was found between field independence and word recognition. Furthermore, the more successful readers could be differentiated from the less successful readers on the basis of field independence-dependence. In a factor analysis study, Cluck (1973) administered several tests including Witkin's Rod and Frame Test and the Children's Embedded Figures Test (CEFT) (both measures of field independence-dependence) and the Stanford Achievement Tests to 54 first grade children. A canonical correlation significantly related the field independent factor to reading achievement. Those reading tests which were measures of letter and phonics knowledge were most strongly related to CEFT.

The collective evidence from these studies indicates some relationship between reading achievement and cognitive style. The exact nature of that relationship is perhaps less clear; however, the studies by Cluck (1973), Cohn (1968), Stone (1976), and Schwartz (1973) suggest that the common ability required in both field independent measures and certain reading tasks is the ability to extract a critical element from a structured

field and reorganize that element into a new structure. Apparently, this ability is necessary in both decoding tasks and certain comprehension tasks that require reorganization of information in problem solving.

A visit to almost any first grade classroom will reveal the use of such terms as "letter", "letter-sound", "word", "sentence", "page", "line", "title", by both the teacher and, though less so, the children. Yet several researchers have shown that many children do not understand these concepts. While the work of Bloom (1970), Bowerman (1973), Brown (1973), and Elkonin (1971) has supported the notion that language is a representation of the cognitive development of a child, in this case, because of the extensive use of these words in the classroom, children may simply have incorporated these words into their lexicon before they have developed a related cognitive scheme. The idea that children do acquire terms before their related cognitive scheme is supported by Beilin's (1975) study of number language development.

Early in any reading instructional program, the concept of word is used. However, as Vygotsky (1962) has pointed out, "in speaking he is hardly conscious of the sounds he pronounces and quite unconscious of the mental operations he performs" (p. 99). However, Vernon (1971) noted that in learning to read, the child is required to construct actively first, word structures, then syntactic and semantic sequences in the form of phrases and sentences" (p. 177). A Russian study cited by Ervin and Miller (1963) as well as the work of Downing (1970a, 1970b, 1971, 1972), Francis (1973), Holden and MacGinitie (1972), Huttenlocher (1964), and Reid (1966) has supported the conclusion that children do not understand the concept of a word as defined by the printer's space and such notions as words are "made of letters," "letters and numerals are different and

serve different purposes," "books contain words," or "stories are in books." Furthermore, these studies have demonstrated that many children are still confused by such concepts after a year of instruction.

Meltzer and Herse (1969) found that after some formal reading instruction, children were using space as a boundary unless the words were short in which case they were combined, or long, in which case they were divided. Long words were divided at "tall letters." Meltzer and Herse concluded that the errors children made in dividing words were a result of the type of reading materials they had used for instruction. This conclusion was supported by Kingston, Weaver, and Figa (1972) who used material from the children's preprimer and primer basal readers as well as adult novels. The most common error found in the basal materials was to combine two words. However, the researchers commented that there seemed to be complete confusion about what constituted a word in the adult novel materials. Kingston et al. argued that the difficulty was in not being able to perceive any word meaning. On the other hand Holden and MacGinitie (1972) found that meaningful phrase units as carried by rhythmic patterns may influence the way in which children divide sentences into words; and, therefore, may interfere with correct segmentation.

Results from the work of Mickish (1974) support the notion that the concept of word boundaries develops not only with increased exposure to a reading situation, but with success in learning how to read. At the end of one year of instruction 1.8, 57 and 81 percent of the children reading at levels II, III, and IV were able to accurately segment the words in six-word sentence patterns printed so that there were no spaces between the words. However, none of the children reading at level I was able to segment the sentence accurately.

In a more recent study, Johns (1980) administered the Concepts About Print Test (Sand) (1972) to 60 first grade children who were determined as either above average, average, or below average readers. Results indicated that there was a significant difference between the total mean scores for each of the three groups with the highest mean score for the above average group and the lowest mean score for the below average group. Furthermore, when individual items of the test were analyzed, it was determined that the mean scores for the above average and/or average groups were significantly greater on all items related to letter-word concepts, advanced-print concepts, and four of the seven print-direction concepts. All children received a perfect score for three of the print-direction concepts and three of the book-orientation concepts. Johns clearly recognizes a limitation with his study that applies to each of the studies in this area, "Is the child's understanding of print-related concepts a cause or a consequence of his/her reading achievement?" (p. 547).

The studies reviewed in each of the areas of cognitive style and linguistic concept knowledge have indicated that there exists some relationship between these areas of cognitive functioning and learning how to read. Obviously, there is a host of variables associated with the task of learning to read. However, the question pertinent to this study concerns the relationship between the areas of cognitive functioning discussed and reading achievement. It may be that there are interrelationships between these areas of cognitive functioning that provide a clearer picture of the underlying cognitive aspects of learning to read than one area can provide alone.

Purpose

The purposes of this study were to: 1) investigate the relationship

between the predictor variables of cognitive style, understanding of linguistic concepts ("letter-sound," "word," and "sentence"), and knowledge of word boundaries; 2) investigate the relationship between the predictor variables and three measures of reading achievement; and 3) compare these relationships in beginning readers with more advanced readers.

Method

Complete data were collected from 35 first and 31 third grade children randomly selected from all first and third grade children in a local school district. The sample proportionately matched the number of children from each of the ethnic groups (Black, Hispanic, Asian and Pacific Islanders and White) enrolled in the school districts. The sample also represented 18 boys and 17 girls at the first grade level and 17 boys and 14 girls at the third grade level. Data from three of the third grade girls were discarded as they moved out of the district before complete data could be gathered.

Data were collected from each subject on an individual basis in two or three separate sittings. Each subject was tested within a two week period. Data for cognitive style (field independence-dependence) were collected through the use of the Children's Embedded Figures Test (Witkin, Oltman, Raskin, & Karp, 1971). Scores from the Children's Embedded Figures Test represent field dependence-independence on a scale from 0 to 25 with field dependence at the low end of the scale and field independence at the high end of the scale. A child with a score of 20 would be considered more field independent than a child with a score of 5.

The test used to measure the subjects' understanding of linguistic

concepts - "letter-sound," "word," and "sentence" - was modeled after the instrument developed by Downing (1970a, 1970b, 1971, 1972). Twenty-five auditory stimuli in five categories - a non-human noise such as a whistle, a human utterance of a single consonant phoneme, a human utterance of a single word, a human utterance of a phrase, and a human utterance of a sentence - were randomly ordered and tape-recorded with a five-second interval between each stimuli. The tape was played three times. On the first round the subject was asked to respond "yes" when he heard a letter-sound and "no" to all other stimuli. On the second round a "yes" response was required for a word, and the third round required a "yes" response for a sentence. A short training game preceded the test in order to acquaint the subjects with the yes-no "game" to a single stimuli. Each correct response received a score of one which resulted in a possible total score of 75.

The subjects' knowledge of word boundaries was measured by using a test designed and described by Holden and MacGinitie (1972). Subjects were given ten poker chips and asked to first respond to a sentence presented orally through the use of a tape recorder by picking up a chip for every word they heard in the sentence and then to find the written sentence which had been typed on a 5" x 8" unlined card four times using a different number of letter clusters achieved by combining and dividing words. For example one sentence was "Children like chocolate candy." The sentence appeared on the card as follows:

Children like chocolate candy.

Children like choc olate candy.

Child ren like choc olate candy.

Child ren like choc olate can dy.

Eight sentences were used four of which were typed using standard spelling and four of which were typed using regular orthography but not standard spelling. For example the sentence, "The boys are going to play ball" was represented as "Sha luys ure joing la fley soll." The four versions of each sentence were randomly ordered on each card. The four sentences which were typed in standard spelling were presented first. A possible total score of sixteen could be achieved by responding correctly to the oral presentation (counting the correct number of chips) and choosing the corresponding sentence correctly written on the card. A training procedure preceded the administration of the test sentences to acquaint the subject with the idea of picking up poker chips for words heard in a sentence.

An individual reading inventory (IRI), The Pupil Placement Tests (Hollander & Reisman, 1970), was used to measure reading. The IRI was chosen in order to obtain three measures of reading achievement - oral reading comprehension, silent reading comprehension, and word recognition for each child. In each case the level of reading achievement was determined as the highest passage read at the instructional reading level. Using Powell's (1969) criteria, oral and silent reading comprehension instructional levels were determined by the percent of correctly answered questions following the reading of each passage and a word recognition instructional level was determined by the percent of total words read correctly in the passage. Miscues counted were substitutions, omissions, insertions, refusals, and mispronunciations.

The data were analyzed through the use of directive statistics and correlations as well as multiple linear regression and commonality analysis (Kerlinger & Pedhazur, 1973). Commonality analysis was used in order to determine the unique contribution in the variance of the dependent variables

(each of the three reading measures) attributable to each of the independent variables. Multiple linear regression was used in order to determine how much of the variance in the dependent variables was contributed by the combined independent variables. Data from each of the grades were analyzed separately.

Results

The means, standard deviation, and range for the predictor and criterion variables are provided in Table 1. The mean scores on the children's Embedded Figures Test of 11.40 and 17.93 for first and third grades respectively represent the expected relative growth in field independence and is consistent with but somewhat higher than the mean scores of the norming population (Witkin, et al., 1971). The norming population mean score for ages seven to eight was 10.6 and for ages nine to ten was 16.4. Because grade levels were used in this study and age levels were used in the norming population, an exact comparison was not possible.

[Insert Table 1]

Group growth in understandings of linguistic concepts and word boundaries is also noted with means of 64.09 and 68.16 for linguistic concepts for first and third grade respectively and mean scores of 13.31 and 15.13 for word boundaries. The range for these variables indicates that some children from both grades achieved low scores as well as the highest score possible. While the mean scores for each of the tests at each grade level indicate that a larger number of children received higher scores at the third grade level, the range of scores for third grade is not substantially smaller than the range of scores for first grade which may indicate that simple exposure to reading instruction does not reduce uncertainty about

TABLE 1

Means, Standard Deviations, and Range for Independent and Dependent Variables

Variables	Grade One (N = 35)			Grade Three (N = 31)		
	Mean	SD	Range	Mean	SD	Range
Cognitive Style	11.40	5.15	4.00 - 22.00	17.93	4.12	7.00 - 24.00
Word Boundaries	13.31	3.02	5.00 - 16.00	15.13	2.06	5.00 - 16.00
Linguistic Concepts	64.09	11.00	22.00 - 75.00	68.16	9.72	29.00 - 75.00
Oral Comprehension	3.31	2.04	0 - 9	6.39	1.61	3 - 9
Silent Comprehension	2.91	2.08	0 - 8	5.97	1.96	1 - 11
Word Recognition	3.74	2.76	0 - 11	7.29	2.47	4 - 11

these concepts.

Growth in the mean reading scores is observed across grade levels, however, the mean score for silent comprehension for grade three and the mean scores for word recognition for both grade one and grade three appear to be suppressed since the upper limit on the range for these areas reached the highest grade level reading passage. An examination of the individual scores for those areas revealed that only one child in grade three reached the highest reading passage for silent comprehension. One child in grade one reached the highest reading passage for word recognition and four children in grade three. Therefore, it would appear as though the only mean score which may have been effected is the mean score for word recognition for grade three.

Tables 2 and 3 show the correlations between all variables for grade one and grade three respectively. It should be noted that in evaluating correlation coefficients with small sample numbers (in this case 35 for first grade and 31 for third grade) confidence intervals are quite broad. For example for a sample size of 35 and a 95 percent chance of the sample correlation coefficient falling within the confidence interval, approximate confidence intervals for the following correlation coefficients are as follows: .30, -.80 to .58; .40, .05 to .64; .50, .18 to .70; .60, .32 to .78 (Steel and Torrie, 1960). Of course with a greater chance (99 percent chance for example) of the sample correlation coefficient falling within the confidence interval, the confidence interval narrows proportionately.

[Insert Tables 2 and 3]

With this note of caution in mind, a number of interesting comments can be made about the correlations. The one significant correlation between

TABLE 2

Intercorrelation Matrix for Independent and Dependent Variables - Grade One (N = 35)

Variables	1	2	3	4	5
1. Cognitive Style					
2. Word Boundaries	.442[a] .008				
3. Linguistic Concepts	.079 .651	.225 .194			
4. Oral Comprehension	.463 .005	.619 1.-4*	.507 .002		
5. Silent Comprehension	.463 .005	.549 .001	.484 .003	.853 1.-4*	
6. Word Recognition	.495 .003	.547 .001	.532 .001	.861 1.-4*	.894 1.-4*

[a]The first number is the correlation coefficient. The second number is the probability level rounded to three digits.

*1.-4=.0001

TABLE 3

Intercorrelation Matrix for Independent and Dependent Variables - Grade Three (N = 31)

Variables	1	2	3	4	5
1. Cognitive Style					
2. Word Boundaries	.393[a] .029				
3. Linguistic Concepts	.134 .472	.207 .264			
4. Oral Comprehension	.356 .049	.377 .037	.491 .005		
5. Silent Comprehension	.516 .003	.249 .177	.389 .031	.757 1.-4*	
6. Word Recognition	.238 .197	.274 .135	.389 .031	.577 .001	.727 1.-4*

[a]The first number is the correlation coefficient. The second number is the probability level rounded to three digits.

*1.-4=.0001

the predictor variables was between cognitive style and word boundaries at both grade levels which suggests that there may be some relationship between the embeddedness task in the Children's Embedded Figures Test and the task used in this study to determine a child's ability to recognize word boundaries. If a word, defined by the printer's space, is considered a part of the whole selection, then the relationship between word boundaries and cognitive style is understandable. Furthermore, the low correlation between linguistic concepts and cognitive style is not surprising since the cognitive style test involved visual perception (Witkin argued that field independence also involves certain problem solving abilities) and the linguistic concepts tasks involved auditory awareness.

Cohen (1977) has suggested that when reviewing Behavioral Science data operational guidelines for determining practical significance of correlation coefficients need to be set as follows: $\underline{r}$ = .10 for small effects; $\underline{r}$ = .30 for medium effects; and $\underline{r}$ = .50 for large effects. If these guidelines are accepted (keeping in mind the larger confidence intervals that exist), then it would appear from this data that there exists a strong relationship between each of the predictor variables and each of the criterion variables at the first grade level but by third grade the relationship has weakened. Not only has the relationship weakened by third grade, but there exists more variability between the predictor variables and the three criterion variables at the third grade level than at the first grade level. As can be seen in Table 2, the greatest correlation is between word boundaries and all three criterion measures followed by linguistic concepts and finally cognitive style. All correlations are significant at the .01 level of significance or less. However at the third grade level there does not exist a consistent pattern and the level of significance varies considerably. It is quite apparent

from the correlations as well as the analysis to follow, that the predictor variables have a much stronger relationship with beginning stages of reading than they do with the more advanced stages of reading.

The multiple stepwise regression analysis indicated that the three predictor variables accounted for 50 percent or better of the variance in all three criterion variables at the first grade level (57, 50, and 56 percent of the variance was accounted for in oral comprehension, silent comprehension, and word recognition respectively). However, only 36, 37, and 21 percent of the variance was accounted for in oral comprehension, silent comprehension, and word recognition respectively at the third grade level.

Commonality analysis is an extension of multiple linear regression analysis in which the total explained variance can be decomposed into variance which is unique to each predictor variable in the model as well as to two or more predictor variables taken together. Table 4 presents the variance unique to each predictor variable for each of the models, the variance common to each set of two predictor variables for each model and the total variance explained by each of the models. With the exception of silent comprehension at the third grade level, linguistic concepts contributed the greatest amount of unique variance in each of the models and of the two variables taken together linguistic concepts and word boundaries accounted for the greatest amount variance in each of the models. However, as can be seen from Table 4 none of the variables is very helpful in explaining the variance in the reading measures.

[Insert Table 4]

Summary and Conclusions

This study examined the relationship between cognitive style (field independence-dependence), knowledge of linguistic concepts ("letter-sound,"

TABLE 4

Percent of unique explained variance contributed by predictor variables to each criterion variable

Criterion Variables	Predictor Variables: Oral Comprehension	Silent Comprehension	Word Recognition
		Grade One	
One Variable			
CogS*	05	06	08
WordB	13	08	07
LingC	14	14	18
Two Variables			
CogS, WordB	31	27	28
CogS, LingC	19	20	26
WordB, LingC	36	29	31
Full Model			
CogS, WordB, LingC	57**	50**	56**
		Grade Three	
One Variable			
CogS	04	19	02
WordB	03	00	02
LingC	17	10	11
Two Variables			
CogS, WordB	12	22	06
CogS, LingC	22	31	13
WordB, LingC	23	10	15
Full Model			
CogS, WordB, LingC	36***	37***	21****

*The full name for the variables are: CogS = Cognitive Style; WordB = Word Boundaries; LingC = Linguistic Concepts

**p .001

***p .01

****nonsignificant

"word," and "sentence"), knowledge of written word boundaries and three measures of reading achievement (oral comprehension, silent comprehension, and word recognition) in first and third grade readers. The children in this study were learning to read through the use of the Economy Company Basal Reader Series (1972) which is highly phonic oriented in its approach to reading. The influence of this series was seen in the higher word recognition scores from the Pupil Placement Test than the scores for oral comprehension and silent comprehension at both the first and third grade levels. The practice of oral reading, round-robin fashion, which has been observed in these schools by the researcher may also explain the higher oral comprehension scores than silent comprehension scores. There is little doubt that if this study had been conducted in a district which emphasized a different approach to reading, different results would have been obtained.

One of the questions investigated in this study asked about the relationship between the predictor variables. It was noted that the only significant relationship between the predictor variables was between cognitive style and word boundaries at both the first and third grades. This result lends support to the idea that sorting out single words from a line of print may require similar ability to separating an element from a surrounding field. Apparently, cognitive style is not related to one's ability to associate an instance of an auditory stimuli to a linguistic concept, i.e., "letter-sound," "word," "sentence." However, this relationship or lack of relationship needs further investigation with instruments that may be more sensitive to the problem. The linguistic concepts measure used auditory stimuli with no accompanying visual stimuli. The differences in the sensory modes may have caused the results. On the other hand if the differences in sensory modes resulted in

a lack of relationship, then it has to be questioned whether or not cognitive style differs with sensory input.

A second question investigated in this study asked about the relationship between the predictor and criterion variables and a third question asked about the stability of those relationships at different grade levels. The results indicated that there was some variability in the relationship between the predictor variables and each of the reading measures at the first grade level and even more variability at the third grade level. Furthermore, the relationships between each set of variables changed across grade levels. When the importance of predictor variables to reading achievement is examined, it is necessary to define and to describe what is meant by reading and what type of instruction is being provided. For example, the results clearly supported the importance of the predictor variables examined in this study for reading achievement at the end of first grade. But it was apparent that the impact changed with the type of reading measure considered as well as with development that occurred at the third grade level.

It is to simple to say that reading is a complex process that involves a set of complex thought processes. It would be more realistic to say that reading involves a number of complex processes that require a number of complex sets of thought processes. Furthermore, there is little doubt that exogenous influences are interacting with a child's unique cognitive structure. Longer exposure to reading instruction, ordinary child growth and development, and individual experience no doubt are intervening. It is likely that the inconsistencies in this study as well as other studies are a direct result of the interaction effects between the combined cognitive traits possessed by an individual child, his stage of growth and set of background experiences, and the type of reading instruction or lack of

instruction provided. The child enters the reading instructional program with a set of cognitive traits that serve as prerequisite abilities for learning how to read. However, there are wide differences in reading approaches and methods and each requires a somewhat different set of prerequisite abilities. The likelihood of success with reading may depend on how close a match exists between the cognitive traits of the child and the prerequisite abilities required by the type of reading program offered. If the gap is not too wide, the child may be able to compensate for weaknesses in certain prerequisite abilities with strength in others, or increased or prolonged instruction may enable the child to learn to read. However, the child's ability to compensate may become less likely as the gap between the child's abilities and the prerequisites required by the reading approach becomes wider.

Before firm conclusions can be made concerning underlying traits necessary for successful reading achievement, research is necessary in a number of areas which investigate the multiple relationships between cognitive traits, different reading instructional programs, different types of reading achievement as measured by a variety of tasks, and stages of development in learning to read. Furthermore, the cross-sectional data collected in this study point to the need for longitudinal investigations. Tracing interactions between an individual child's unique pattern of cognitive development, his progression in learning how to read, and the instructional program will provide a much clearer picture of the developmental process than can be gleaned from cross-sectional data.

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